Volume 12, Number 2

Spring 1982

noaa

Volume 12
Number 2
Spring 1982

noaa

Newsline 3

Time's Running Out on the Hurricane Coast 4
Coastal areas face increased dangers from a devastating storm as builders move closer to the water's edge.

NOAA's Weather and Fisheries Leaders Reveal Plans and Priorities 6
William G. Gordon and Richard E. Hallgren answer a wide range of questions.

NOAA's High-Flying Dolphin Detectors 8
Satellite tracking methods are giving scientists valuable information on the behavior of these possibly endangered sea mammals.

PROFS: Localizing the Weather Forecast 10
A new system for providing faster, more accurate weather forecasts of such dangerous small-scale phenomena as tornadoes is under development.

NOAA's Western Regional Center—A Good Neighbor 12
The good will of many local citizens helped smooth the often rocky road to a new NOAA facility in Seattle.

Directions 14

A Ship With Two Bosuns 16
NOAA's Davidson fulfills its mission as a costal hydrographic survey ship with both a human and mechanical bosun aboard.

Probing the Dangers of Wingtip Whirlwinds 18
Radar techniques developed by NOAA now can identify small but powerful vortices created by large aircraft that endanger smaller planes.

National Flash Flood Awareness Week 22
A special effort is mounted to inform the Nation of the dangers of flash floods.

View From Space 23
The Big Snow

Radio "Hams" Fill A Data Gap 24
Amateur radio operators in Washington State provide Weather Service flood forecasters with observations from the Mount St. Helens area.

City Scape 26
City Scape Goes Country

Seafare 27
Slenderizing With Seafood

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration
Dr. John V. Byrne, Administrator

A. Joseph LaCovey
Director, Public Affairs

Thomas B. Calhoun
Art Director

Views expressed by authors do not necessarily reflect NOAA policy. No permission necessary to reproduce contents except copyright photos and other material.

NOAA (USPS 417-370) is published quarterly by the Office of Public Affairs, National Oceanic and Atmospheric Administration, Rockville, Md. 20852, to acquaint readers with the policies and programs of the agency. The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1982.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription price: $8.00 domestic, $10.00 foreign, $2.25 single copy domestic, $2.85 single copy foreign. Second Class postage paid to Finance Dept., USPS, Washington, D.C. 20260.

Newsline

Blockbuster Tornado Measured

NOAA scientists have obtained the first radar measurements of the size, shape, speed, and power of a tornado. The storm, which carved 14 miles of destruction near Binger, Okla., May 22, 1981, generated 196-mile winds, hurled cattle, oil tanks and trucks aside at 43 miles an hour, averaged a half-mile in width and grew to a height of 7.5 miles. Drs. Donald Burgess, Harry Hennington and Dusan Zrnic of the National Severe Storms Laboratory and Dr. Les R. Lemon of Sperry Corporation conducted the experiment with Doppler radar. They hope it may lead to tornado spotting from above the storm clouds.

Hecht To Climate Post

Dr. Alan D. Hecht, Director of the National Science Foundation's climate dynamics program, has been appointed Director of the National Climate Program Office, a NOAA-based interagency program responsible, among other duties, for preparing the national 5-year climate plan.

World's End? Not This Time

NOAA's Space Environmental Services Center received a flood of apprehensive phone calls in the week or so preceding March 10.

Most people didn't come right out and say it but what they really wanted to know was, well, will the world come to an end on the 10th? They had read, or heard of, a book, "The Jupiter Effect," which predicted dire consequences to Earth when the 9 planets line up on one side of the sun—and the 10th was the fateful date.

Patrick S. McIntosh, a solar forecaster, reassured one and all that although the planets would be on one side of the sun on March 10, they would be scattered over nearly 90 degrees of an angle. Even if the alignment were perfect, in fact, there would be no effect on earth. McIntosh's prediction, happily, was on the nose.

Fish Conservation Planned

The United States is moving forward in two major conservation areas, the National Marine Fisheries Service has revealed. Officials from the U.S, Japan, Canada and Brazil have recommended to their governments new catch limits for bluefin tuna in the western Atlantic: 605 metric tons to the U.S., 305 to Japan, 250 to Canada; no change for Brazil and Cuba, whose catch is minor; and no directed fishery on the spawning stock of the Gulf of Mexico.

Delegations from the U.S., Canada, Denmark, Iceland, Norway and the European Economic Community have proposed to their governments that all salmon fishing in the North Atlantic, with two minor exceptions, be prohibited beyond 12 miles of a country's coastline. The delegations also approved creation of a North Atlantic Salmon Conservation Organization. Once U.S. officials sign the convention, it will go to the Senate for ratification.

NOS Celebrates Its 175th

One hundred and seventy-five years ago, one of Thomas Jefferson's dreams came true: the establishment of a Survey of the Coast. On February 10, alive and well and working throughout the Nation and on the high seas, the National Ocean Survey celebrated the anniversary with business as usual. Founded to provide accurate charts for safe coastal navigation, the Survey's mission has grown tremendously: its most recent triumph was finding what may be many millions of dollars' worth of strategic minerals on the ocean floor.

Honors for NOAA Scientists

Dr. Earl Droessler, Director of University Affairs, has been named president-elect of the American Meterological Society. His election cams as Dr. Neil Frank, Director of the National Hurricane Center, was elected to the AMS Council.

Dr. Rex Fleming, who led United States participation in the Global Weather Experiment, and Dr. Kendall L. Svendsen of EDIS's Geophysical and Solar-Terrestrial Data Center, have been elected Fellows of the American Association for the Advancement of Science.

The Ones That Didn't Get Away

Good news for the West Coast's albacore tuna fishermen: National Marine Fisheries Service scientists R. Michael Laurs and Ronald Dotson dispatched six chartered vessels to run long-line experiments in waters not normally fished for albacore. In 20 days, they caught from 4 to 12 tuna each, the average day providing about 1,000 pounds per vessel—enough to make the trip worthwhile. In a related experiment tuna tagged with ultrasonic transmitters confirmed the belief the species cues on the thermocline, that layer separating the warmer surface water from the colder depths.

It's Curable: Cold Water Drowning

Spring is here, but there's still plenty of cold water in our oceans, lakes, and streams, so it's important to remember that many apparent drowning victims can be saved. The secret: aggressive, prolonged, resuscitation efforts, continued until a physician is present.

Some victims submerged up to 30 minutes have been saved, without brain damage, when closed-chest massage and mouth-to-mouth breathing were begun immediately and continued for several hours. In 25 such cases, 20 persons were saved without brain damage, 2 suffered physical damage, 1 failed to survive. NOAA research has shown the lifesaving mechanism is the mammalian diving reflex, triggered by submersion in water under 70 degrees, which halts breathing; redistributes oxygen to the heart, lungs, and brain; and prolongs survival.

Fish Leftovers Not Wasted

Protein-rich fish heads, tails, and bones, normally discarded by fish processors, may help cattle, sheep, and poultry raisers beat rising costs of feed while giving processors a new product.

A team of NOAA fisheries scientists in Seattle studying fish silage as a possible aquaculture food ingredient, reports treated fish wastes also could replace fish meal, an important ingredient in feed for some livestock which is increasing in price and decreasing in availability.

Sea Level: On The Up and Up?

Shrinking polar icecaps may be causing the Earth's sea level to rise, and days to grow infinitesimally longer, NOAA scientists Robert Etkins and Edward Epstein report.

Global sea levels have risen slightly more than one-tenth of an inch yearly, on the average, since 1940—triple the rate of rise during the preceding 50 years. Etkins and Epstein estimate that more than 10,000 cubic miles of polar ice have melted in the past 40 years, and that transferred to a thin layer of water spread over the world's oceans would tend to reduce the speed of the Earth's rotation. This, they say, would lengthen each day by about one-thousandth of a second, accounting for about three-fourths of the actual increase in the length of the day observed by scientists over the past 40 years.

Time's Running Out On the Hurricane Coast

Don Witten

"If you come to the Gulf or Atlantic Coasts and build your home on one of the barrier islands, don't fuss about hurricanes. I believe hurricanes have a right to sweep across our barrier islands every few years. I am not sure it was intended that we should live there. So be it, we have decided to do so; and this has generated a serious hurricane problem."

This is what Dr. Neil L. Frank, Director of NOAA's National Hurricane Center, told the U.S. Senate Subcommittee on Environmental Pollution in advance of the 1982 hurricane season.

"If we would learn to live in harmony with nature, we could minimize our problems" he said. "Hurricanes are not freak acts of nature designed to inflict death and destruction on people. We have a tendency to believe this because that is the way we measure the impact of a hurricane. But, in fact, hurricanes perform a very useful function in the atmosphere."

Too much heat can build up in the tropical regions during the summer, Frank explained. This heat has to be released, and the hurricane is nature's way of doing that. In effect, the hurricane represents a tropical atmospheric boiling. Heat is removed when the storm moves out of the tropical regions.

Coastal populations have been rising dramatically in the United States. Atlantic and Gulf Coast populations are estimated at over 61 million people, and climbing steadily. There are as many Americans living in the 611 coastal counties from Maine to Texas as occupied all of the United States at the turn of the century.

Generally, people associate strong winds and heavy rains with hurricanes. But the real killer produced by these storms is the storm surge—a dome of water maybe 50 miles wide that sweeps across the coast where the eye of the hurricane strikes land. Huge waves atop this dome of water pound the shoreline and inundate low-lying escape routes from the shore. Nine out of ten people who die in a hurricane drown in the storm surge.

"Consider what the storm surge does to a barrier island," Frank noted.

"In 1938, a major hurricane devastated the south coast of New England and the eastern part of Long Island. Before the storm, there were 179 homes of Hampton Beach, a barrier island. Only 26 remained after the storm. I visited West Hampton Beach in 1979 and counted 900 homes in that same area," Frank told the Subcommittee.

In his testimony, Frank cited numerous other examples of how the barrier islands have been destroyed by hurricanes only to be rebuilt. Here are a few of them:

- On the New Jersey coast, Absecan Inlet separates Brigantine Island from Atlantic City. There is a natural migration on the sand from the north to the south on the Jersey coast, and this kept filling up the inlet. The Corps of Engineers solved the problem several years ago by building a jetty on the north side of Absecan Inlet. A large sand bar formed north of the jetty, and a developer recently built 250 homes on the sand bar. While the people do not believe they have a hurricane problem, the records show three severe hurricanes in the 1800's destroyed large portions of Brigantine Island.
- On the North Carolina coast, Long Beach Island is located south of Wilmington. In 1954, there were 357 homes in that community before Hurricane Hazel arrived. After the storm, only five of those homes remained. There are 2,000 homes in that area today.
- Seabrook, Kiawah, and Hilton Head islands are located on the South Carolina coast. In 1893, 20 feet of water associated with a severe hurricane inundated all of the islands on the South Carolina coast, and 2,000 lives were lost. This was a bad year for hurricanes because another 2,000 persons on the Louisiana coast were lost.
- Farther south there are 70,000 people in the Florida Keys today, and their escape route is a narrow two-lane road with 50 bridges. A recent study by the Governor's

The inexorably rising, wind-driven water of the storm surge is the hurricane's greatest threat to life and property.

staff shows it will take over 20 hours to evacuate. The National Hurricane Center strives to give 12 hours of daylight as a lead time for warnings.

Recent comprehensive evacuation studies for a five-county area around Ft. Myers, Fla., show it will take between 20 and 30 hours to evacuate. Similar studies for Tampa Bay and Galveston Bay indicate evacuation times in excess of 20 hours. The minimum evacuation time for other extremely vulnerable communities, such as New Orleans and the Jersey coast, is not known. It seems certain, however, that the time will probably be in excess of the 12-hour lead time NOAA provides.

On the south Texas coast, Hurricane Beulah put over 30 new cuts through Padre Island in 1967. In time, the sand filled back in these cuts. Today, condominiums are located in these old washovers.

Galveston Island was the scene of the worst disaster in the United States. Some 6,000 lives were lost in a hurricane when the island was inundated in 1900. After the hurricane, a 17-foot seawall was built to protect the city. Down through the years this seawall has done a nice job of protecting the city, but it destroyed the beach. The sand gradually drifted to the east and collected on the southeast part of Galveston Island. Today a new condominium can be found on Galveston Island—ahead of the seawall.

Hurricane Allen, in 1980, came ashore on the most sparsely populated segment of Padre Island, between Corpus Christi and Brownsville, Tex. At one time, this hurricane was the second most powerful in the Atlantic. Fortunately, it weakened as it came ashore.

"While the precise dimensions of Allen's storm surge are not known, I counted over 50 cuts and washovers in a 50-mile stretch of Padre Island, north of the developed area on the southern part of the island. The first such cut was only a few hundred yards north of a condominium in the Brownsville area," Frank said.

"This Nation has a very serious hurricane problem. We are more vulnerable to the hurricane than we have ever been in our history. Poor building codes, out-of-date evacuation plans, and overdevelopment are setting the stage for a major disaster," he added.

"There is more than just an economic and physical resource on barrier islands," said Frank. "There is also a human resource. Unless we do something very quickly to protect that human resource, we may have a hurricane disaster where the death toll will equal or exceed that which we experienced in Galveston in 1900. ■

Storm Surge—Doing Something About It

Densely populated areas along the Atlantic and Gulf Coasts where hurricanes could cause dangerous flooding will get early warning of such threats through the use of computer models being developed by the National Weather Service. And when a hurricane warning is issued, many coastal areas will depend on storm evacuation maps produced by the National Ocean Survey.

The computer models take into account storm size and speed as well as coastal topography features which contribute to coastal flooding when a hurricane strikes Storm surge flooding can reach heights 25 feet above sea level.

The National Hurricane Center in Miami uses the models to predict storm surge whenever a tropical storm threatens a coastal region. Communities along the coast also use the models for planning purposes and to generate data with hypothetical storms for storm evacuation studies.

Each of the models contains topographical information on lake and river basin configuration and water levels, levee systems, roads, and other geographical features. The models can be used to compute the storm surge resulting from various combinations of wind and pressure brought by the storm.

Test models have been developed for the New Orleans area; Lake Okeechobee, Charlotte Harbor, and Tampa Bay, Fla.; and Galveston, Tex. Models nearing completion for the 1982 hurricane season are for: Pamlico Sound, N.C.; Charleston Harbor, S.C.; Pensacola Bay, Fla.; and Corpus Christi and Lake Sabine, Tex.

The National Ocean Survey has been compiling and printing storm evacuation maps of the Gulf and East Coasts since 1971. These maps, currently available for the great majority of the hurricane-prone Atlantic and Gulf Coasts from New York to Texas, show flood prone zones, evacuation routes and critical elevations along the routes, and high points or havens of refuge. Populations of towns, route numbers, and geographic names are printed on the map for information purposes.

NOAA has completed 110 of 167 maps originally planned, with 38 compiled manuscripts awaiting field edit. At the present rate of production, it will be 1986 before completion of this project.

The information contained on evacuation maps are the road elevations, especially the low points along the road. The elevations are used to determine roads which may be flooded prior to the actual arrival of the storm.

Credit: DOCUMERICA, Hope Alexander

A major disaster could overwhelm communities developed on the coastal barrier islands with no planning for emergency evacuation.

NOAA's Weather and Fisheries Le

FISHERIES: "A more aggressive leadership role..."

William G. Gordon
Assistant Administrator for Fisheries

William G. Gordon
Assistant Administrator For Fisheries

Q. ***Fisheries Service has broad responsibilities ranging from preserving marine resources to managing their use. How would you rank these responsibilities?***

A. I look at the Fisheries Service as having five principal areas of responsibility. I would put management of fisheries first. Second, I would have to put managing marine mammals and endangered species. Third, habitat conservation, so that habitats and the animals themselves remain productive. Fourth, concern for pollution in the environment and its potential effect on human health in foods. And last, fisheries development which is aimed at developing an atmosphere in which our industry can prosper and expand as a member, not only of the U.S. economy, but of the world economy.

Q. ***An estimated 15 percent of the world's supply of fishery products is within 200 miles of the U.S. coast, yet the United States imports more than 50 percent of the edible fish that are consumed in this country. Why?***

A. Principally because the products that are among our highest imports are fish blocks of cod which are remanufactured in sticks and portions. A good part of that is high-quality cod caught in the Arctic off Greenland, Iceland, Norway, and in the Barents Sea. This large quantity of cod is not available in the U.S. zone, never has been, never will be, so we look elsewhere for it. Other large imports are shrimp and tuna. Roughly half the shrimp we consume is imported and a good portion of the tuna also is imported.

Q. ***We understand that fishery imports are the third largest contributor to the U.S. trade deficit, above steel and some other major commodities. What's being done to reduce this deficit?***

A. Two things. One, to encourage foreign fishing interests to buy more products from the United States—that is happening in that they're focusing on some of the more highly valued species such as salmon, crab, lobsters, and to a lesser extent oysters and other species. Two, we're encouraging U.S. processors and distributors to use species that have little use here in the United States, such as squid, hakes, Alaska pollock, Alaskan cod, and species that are classified as underutilized in the United States.

Q. ***One of the major goals of the National Marine Fisheries Service is to increase fishery contributions to the gross national product. How will you do that?***

A. First, we must recognize that there is a broader industry here than most people believe. There's a large recreational industry as well as the commercial. We think we can affect both areas: first, by encouraging the recreational industry to expand through greater use of the resources for recreational purposes. Second, to get the commercial industry to develop some of the underutilized species and market them more aggressively in competition with red meats and poultry.

Q. ***One of the prime goals of the Admin- is to reduce regulations. What is NMFS doing to reduce regulation in the fishing industry?***

A. Taking two attacks. When it comes to conservation, the Regional Fishery Management Councils that are developing the management plans often have constructed fairly complicated management regimes. We're working with the Councils to simplify those plans—to limit the regulations to those that are truly essential for conservation and wise management, and to make those as simple as possible. And there's another side of it, where the industry has been subjected to a wide range of regulations from such agencies as the Environmental Protection Agency, the Occupational Safety and Health Administration, and the Food and Drug Administration. We are now working with those agencies to identify burdensome regulations and to reduce regulations that affect the fishing industry. So it isn't solely our regulations. We're trying to reduce them throughout government.

Q. ***In a nutshell, where are you trying to go with the Fisheries Service as it relates to the industry?***

A. I would hope that the Fisheries Service can take a more aggressive leadership role as an advocate for the fishing industry in its broadest sense, recreational and commercial, and to take advantage of the big potential that extended jurisdiction for fisheries has made available to us. Clearly, the Magnuson Act gave the American fisherman opportunity to be number one in the U.S. zone. The Fisheries Service must take a leadership role and seek out changes in policy and legislation that will create an atmosphere in which our industry can prosper. If we can do that, the industry has an excellent opportunity to prosper and to grow.

Q. ***You talk about the fishing industry prospering, but clearly, for the domestic fishing industry to prosper some sort of change in the marketplace must take place. What needs to happen to make American fishery products more attractive in the marketplace today?***

A. There has to be a greater awareness by the American consumer that fish are high quality protein. The industry has a role to play, not only in marketing its product but in its handling, refrigeration, processing, and packaging so that a high quality, wholesome product is readily available to the U.S. homemaker and seafood buyer. I stress high quality.

Q. ***Do other nations do this better than we do in the United States?***

A. Many nations do and other nations who do not have become aware that this is one of the major impediments to a better use of seafood products—quality assurance in the marketplace, both here and abroad.

(Continued on p. 20)

eaders Reveal Plans and Priorities

WEATHER: "The bottom line is to protect life and property..."

Richard E. Hallgren
Director, National Weather Service

Dr. Richard E. Hallgren
Director of the National Weather Service

Q. ***What is the National Weather Service's most important mission?***

A. To provide the public with the best possible severe weather and flood warnings—in the most timely way. The bottom line is to protect life and property through our forecasts and warnings.

Q. ***What do you see as the National Weather Service's most important element in providing this service?***

A. Our people. They're the backbone of a successful service. You must have people who not only can make quick decisions and issue accurate and timely warnings and forecasts, but who also are sensitive to the problems and interests of the area they serve.

Q. ***The National Weather Service uses a lot of technological equipment and new technology is constantly evolving. What effect will this have on the future weather service?***

A. All of the varied technology is aimed at helping our people do a better job of warnings and, of course, improving the public weather forecast. Technology will help them reduce the manual tasks they now perform. It will permit the optimum operation of all the links in the system—detection, communication, analysis, and dissemination. It will free forecasters to spend more time analyzing the meteorological situations. The result will be a better warning or a better forecast.

Q. ***Where do we stand on the Automation of Field Operations and Services (AFOS) system now? You've had some problems.***

A. We've solved the big problems in the system. AFOS is now in place across the contiguous 48 States—and performing well. It should be in full operation in the fall of this year. But we're improving it, and AFOS is only the beginning in the use of this type of technology in our field operations. We will continue to make improvements in the present system. And we're already beginning to design a future system that will enable us to take advantage of advanced technology. Future advances will generate so much data—particularly radar and satellite information—that it would saturate the present system. We hope to have the new system in place by the end of the decade.

Q. ***One of your new endeavors is called NEXRAD. What is it and why is it important?***

A. NEXRAD stands for Next Generation Radar. It is vital that we have it. Radar is still the most important element for detecting severe weather. The radars we're now operating across the country are 1957 vintage. They have served us well, but there's a limit to how long you can operate the old radars, and we're rapidly approaching that limit. In NEXRAD we're taking advantage of research that has been done in NOAA's Environmental Research Laboratories, at the National Center for Atmospheric Research, and in some of our universities, to introduce a better radar system than ever before. Using Doppler capability, we can see inside a storm, see the velocities, see where vortices are developing, see the shape of storm-scale weather phenomena at an early stage and in more detail. This could bring a whole new dimension to our ability to get out earlier and more precise warnings.

Q. ***In addition to NEXRAD and AFOS, what other developments will be needed in the 1980's?***

A. The technology that's being applied at the National Meteorological Center is another dimension. Getting better guidance to the field operations entails better analysis and forecast models at NMC. And this brings into consideration the use of the very largest and fastest computers available.

We must also automate the surface observations. Whenever there's a great deal of weather around with its ever-changing conditions, our personnel at weather stations are kept busy just taking observations. This happens at the exact time that they should be putting out more warnings or amending forecasts. So, if we can automate the surface observation program as much as possible, those persons will be free to concentrate on providing service to those who need it most severely.

Q. ***How does NWS get its forecasts to the public?***

A. Our prime way to get weather information to the news media and other mass disseminators is the NOAA Weather Wire, a teletyprinter circuit run on a State-by-State basis, with interstate connections. Whenever a warning is prepared with AFOS, it will automatically go on the NWW and to radio, commercial television, cable television, wire services, and newspapers for relay to the public.

Q. ***What other dissemination methods do you use?***

A. We use every possible means to deliver our products—particularly our warnings. We must try to reach people wherever they may be at a given moment—in a car, out shopping, at a factory, in a hospital, etc. Our NOAA Weather Radio is becoming more and more important in getting the information directly to the public. For example, many schools have a NOAA Weather Radio receiver and use it to alert the students when a weather warning is sounded. There are NOAA Weather Radio receivers at rest stops in 35 States, providing travelers with up-to-date weather observations and forecasts. Many radio and television stations rebroadcast our NOAA Weather Radio warnings. About 57 million homes in the United States are within listening range of NWR broadcasts. I expect the number of people relying on it will continue to grow as more become aware of it.

(Continued on p. 21)

NOAA's High Flying Dolphin Detectors

William J. Brennan

Of all the inhabitants of the world's oceans, none seems to have captured the imagination of humans as have dolphins, those playful vagabonds endowed, many think, with an intelligence approaching our own. They appear to wander as they will, at their own pace and in their own chosen direction. They personify freedom, an enviable freedom of choice, going where they want, when they want.

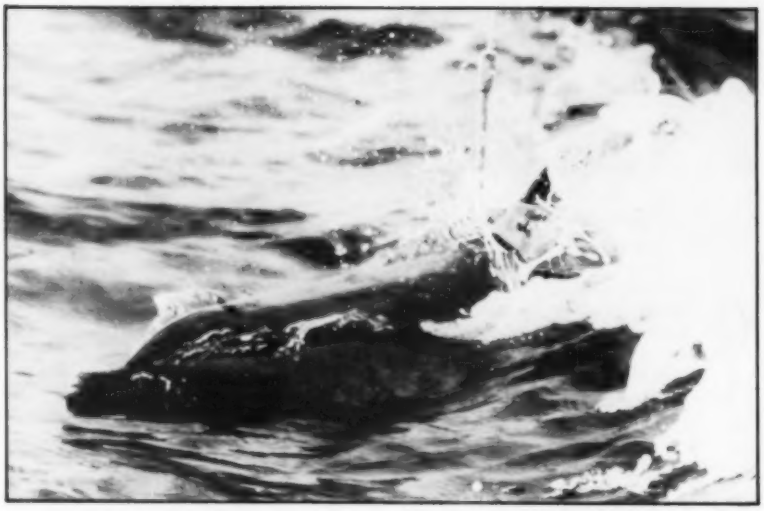
But Mother Nature has thrown some dolphins a curve. Unexplainedly, the lives of spotted dolphins have been intertwined with those of yellowfin tuna in the eastern tropical Pacific Ocean. And because this species of tuna, greatly desired by humans as food, often swims beneath schools of dolphins, the dolphins themselves are imperiled by fishermen seeking the profitable tuna. In spite of the fishermen's best efforts, dolphins become entangled in nets set for tuna, and in the course of a single tuna season as many as 20,000 dolphins may lose their lives.

In some circles it is *believed* that the spotted dolphin population can bear this loss and still remain unthreatened as a species. But believing and knowing are two different things, and for this reason—among others—an assessment of the dolphin population, and a greater understanding of the habits of dolphins, are greatly desired.

Vital Questions

But how do you determine how many spotted dolphins there are in five million square miles of the eastern tropical Pacific? How do you learn where they go, and with what other schools of dolphin they associate? How do you find the answers, particularly when dolpins appear to follow no set pattern of migratory behavior? It's enough to drive those concerned with marine mammal behavior right up the wall.

In scientific terms, schools of spotted dolphins appear to lack cohesive behavior. Individual dolphins, as well as groups, are capable of taking off from the school at large, splitting away on their own, causing no little difficulty for those charged with observing the movements and distribution of stocks.



A spotted dolphin wearing a prototype satellite transmitter splashes to the surface momentarily revealing its antenna. At top, NOAA's Jacqueline G. Jennings monitors the dolphin tracking equipment from the cabin of a small aircraft.

Conventional tracking, using airplanes or ships, can cost more than $10,000 a day, prohibitive in the best of times. Worse, conventional tracking systems easily can lose the animal's movement and behavior.

A means for effective, cost-efficient tracking of dolphins has existed, however, since the early 1960's, when operational polar-orbiting satellites first were launched. And in the years between then and now, these satellites have, in fact, been used to track elk, polar bears, sea turtles, Arctic explorers, sailboats crossing the Atlantic, and a variety of other nomadic animals and people. But an overwhelming difference between these and dolphins has, until now, frustrated marine biologists. Unlike any of the above, the dolphin spends most of its time beneath the surface of the sea, surfacing frequently, to be sure, but only for moments. Available transmitter-satellite systems, which require the transmitter to be above water in order for a signal to be sent, need longer surface time than dolphins usually are willing, or able, to offer.

A Prototype Transmitter

This past summer, following five years of research and development, a team headed by NOAA marine biologist Jacqueline G. Jennings at the National Marine Fisheries Service's Southwest Fisheries Center in La Jolla, Calif., broke the barrier, producing a prototype lightweight transmitter for long-term

Raymond K. Stives, a biological technician at the Southwest Fisheries Center, applies a satellite pack to a dolphin before releasing it in the Pacific off Hawaii. Helpers comfort the animal and keep its sensitive skin wet.

use on wild dolphins at sea.

The smallest animal satellite pack ever developed, the prototype differs in several other significant ways from earlier transmitters. Perhaps most imaginative is the use of a saltwater switch which detects the absence of sea water and automatically triggers a transmission. An electrical current runs from the tip of a 7-inch antenna to one of two cylindrical tubes attached on either side of the dolphin's dorsal fin. When the dolphin lunges in typical fashion up out of the water, the current flow is interrupted, activating the switch and the transmission.

Dolphins normally surface for only about a second and a half, accompanied, obviously, by some splashing water. This created difficulty in keeping the antenna "dry" long enough for a full signal to be sent. Initially in her experimentation, Jennings was using the NIMBUS-6 satellite to relay the transmission from the dolphin to her receiving station. This transmitter-satellite system required a series of four "dry" transmission times of almost a full second each to permit the location of the dolphin to be determined, and often the dolphin failed to cooperate, submerging too soon. Jennings made a "quick fix" by placing the antenna on a small pedestal which elevated it somewhat above the splashing water, but this was recognized as a temporary solution only.

Solving the Splash Problem

A permanent correction was found in Jennings' own back yard, so to speak. A sister NOAA agency, the National Earth Satellite Service, operates the polar-orbiting TIROS-N/NOAA satellite series which includes the ARGOS data collection system, managed by the Centre National d'Estudes Spatiales of France. This system needs transmissions of only about a third of a second to locate the source of a signal.

As with the NIMBUS-6 system, at least four complete transmissions must be received with a 15-minute period while the satellite is overhead to accurately determine the transmitter location within about 6 miles. Fortunately, dolphins surface about 20 times every 15 minutes; plenty of time to allow at least four transmissions to be made.

In her research using two adult wild spotted dolphins, Jennings set a main timing circuit to the instrument pack to transmit during a 4-hour period daily, coinciding with the satellite's orbits. The circuit can be adjusted, however, to transmit at weekly, rather than daily, intervals, prolonging the life of the batteries which power the tiny transmitter. The batteries are contained in the second of the two cylinders at the dolphin's dorsal fin; the other containing the electronics.

Saddling a Dolphin

Each aluminum cylinder, complete with contents, weights about 16 ounces and is some 7 inches long with a diameter of about 2 inches. One counterbalances the other at the dolphin's fin, held in place by a custom-made saddle attached to the fin with stainless steel bolts especially covered to promote healing of the fin after attachment.

Having proven the feasibility of tracking wild dolphins at sea by satellite, Jennings now looks to the opportunity of using the system to expand her dolphin study. For the potential hardly ends with dolphin tracking. Marine biologists believe the transmitter developed by Jennings eventually could be modified to sense and transmit a variety of biological information such as heart-beat rates and depths of dives, not only of dolphins but other sea mammals such as whales, as well as information on the ocean environment through which the mammal was passing.

While perhaps stretching the mind a bit, the pioneering effort by Jennings could some day end up providing the world with a corps of ocean-roving remote sensors. Perhaps the dolphin-borne sensors will provide significant sea surface and sub-surface information to scientists for such purposes as monitoring ocean pollution, determining interaction between the ocean and the immediate atmosphere, and other uses.

As with any new tool, the future use of Jennings' transmitter appears limited only by the imagination of those who have the opportunity to put it to work, now that it has been developed and proven. ▪

PROFS

Localizing the Weather Forecast

Louise Purrett-Carroll

Some of the deadliest weather is also the hardest to predict. Tornadoes, flash floods, lightning, and high winds together kill more than 400 persons each year in the United States. Property damage runs into the billions of dollars.

Some of these meteorological manglers may strike only a very small area, and they may strike suddenly. That's what makes them hard to predict.

A major NOAA program, the Prototype Observing and Forecasting Service, or PROFS, aims to give forecasters a better means of providing faster, more accurate predictions of these relatively small-scale phenomena.

"Scale" is the keyword.

Present-day weather services see weather first on the grand scale of fronts and jet streams, the scale of States and regions, and then on the local scale of cities, counties, and individual thunderstorms.

Weather observations are collected by instrumented balloons called radiosondes launched twice a day from points several hundred kilometers apart; by networks of surface instruments; and by satellites.

The data go into numerical models simulating how the atmosphere behaves, for a prediction of general weather conditions over regional geographic areas and periods of a few days. Weather forecasts on the local scale are derived by fine-tuning parts of this picture. The large-scale data are combined with local observations, such as radar images. The wide spacing of these observations, plus limitations on the resolution of the models and on scientists' understanding of the atmosphere, mean that many of the weather events that most affect our lives and economy cannot be accurately predicted.

System Technology Exists

PROFS will change that, its planners believe. Further, they say the technology to do so already exists. It just needs to be identified, selected, perhaps modified, and finally melded into a cohesive system, an improved local weather service tailored to specific geographic areas.

For example, within NOAA new remote sensors that can measure winds, pollution, temperatures, or inversions have been developed and are being used for research. But, says Dr. A.E. MacDonald, a National Weather Service meteorologist working on PROFS, "It's hard for technology developed for research to make it to operations. It doesn't migrate naturally, by itself, to the Weather Service."

"What we do," says PROFS director Dr. Donald Beran, "is provide a systematic way of transferring this backlog of technology to operational forecasting."

Planning an improved local service, through PROFS, would take into account such factors as a city's economy, size, and geographic setting. All facets of weather forecasting for the local environment, from data collection to dissemination of warnings, will be examined.

The "factory" for building such a system is the Exploratory Development Facility, an experimental forecast office where all the variables that go into a forecast can be tested and manipulated—the type of data, how they are displayed, workstation configuration. The facility, located in Boulder, Colo., is intended to be as close to an operational setting as possible. Data on real weather events are collected with various sensors and played back to a large number of forecasters, with different elements added or subtracted. The forecaster then uses the data to prepare simulated forecasts, watches, and warnings. Several forecasters may be trying to predict the same event, presented in different ways. The accuracy of the forecast is how the different elements in the system are graded.

The underlying question is: what is needed to make a good forecast? "Given an infinite amount of money," says Beran, "of course we could improve forecasts. But what is most valuable, most cost-effective?" What information is critical, and what can be dispensed with if costs are too high? The search for efficiency is a PROFS priority.

Supplemental Services

The local weather service PROFS planners envision would supplement existing services, not replace them. Precise data on weather conditions over a horizontal radius of perhaps a hundred kilometers would flow automatically and rapidly into a central office, where advanced computers process and display them in easily interpreted forms. With these data, the forecaster could issue up-to-the-minute descriptions of current conditions and very short range forecasts that are continually updated. If a hazard such as a tornado develops, the danger area could

In an experimental "weather station" in Boulder, researchers are testing new technologies that may greatly improve operational weather forecasting.

be pinpointed, so that only those who need to can take shelter.

Rapid, accurate forecasts are no good, however, if they don't reach the people who need them. So equally rapid, easily understood, means must be found to disseminate the improved forecasts. Among the possibilities, in addition to today's outlets, such as the news media and NOAA Weather Radio, are specialized video displays; direct closed circuit systems to public officials; emergency telephone alert systems or emergency radio and TV activation systems, to alert households of impending hazards. A highway patrol office might have a computer terminal that it can use to interact directly with the weather forecast office for notice of ice on the interstate or local flooding that could tangle traffic during rush hour.

All these are already being developed by private industry.

Initial Experiment

The first major experiment of PROFS has recently been completed. Data on spring and summer storms in eastern Colorado, Kansas, and Oklahoma were collected and recorded in PROFS computers. The data came from satellites, conventional weather radars at Limon, Colo., and Cheyenne, Wyo., the National Weather Service's AFOS (Automation of Field Operations and Services) network, and a network of automated ground stations. The data were all types that weather offices already receive. They were simply processed and displayed in new ways. But the differences were dramatic.

Satellite images blended with radar in the PROFS computers could highlight severe storms as patches of red in the cloud cover on a screen. Data from the surface network were converted to "streamlines," curving patterns showing wind flow. When radar images of precipitation are superimposed on these, strengthening storm areas can be identified.

Forecasters participating in the experiment—from the NWS, the Air Force, and a private meteorological firm—used various combinations of data to prepare forecasts. Their forecasts were then compared with what actually ensued on the day in question. Since actual forecasters are the ones who know best what they need, the forecasters also gave their personal evaluations of the usefulness of the various tools, and suggested changes or improvements.

Forecasters Impressed

The forecasters who participated in the experiment agreed PROFS capabilities were impressive. "If this much can be done with conventional data sources," MacDonald points out, "think what might be possible with some of the new techniques, such as Doppler radars or the Profiler. The Profiler, developed by NOAA's Wave Propagation Laboratory, provides continuous measurements of temperature, humidity, and wind up through the atmosphere.

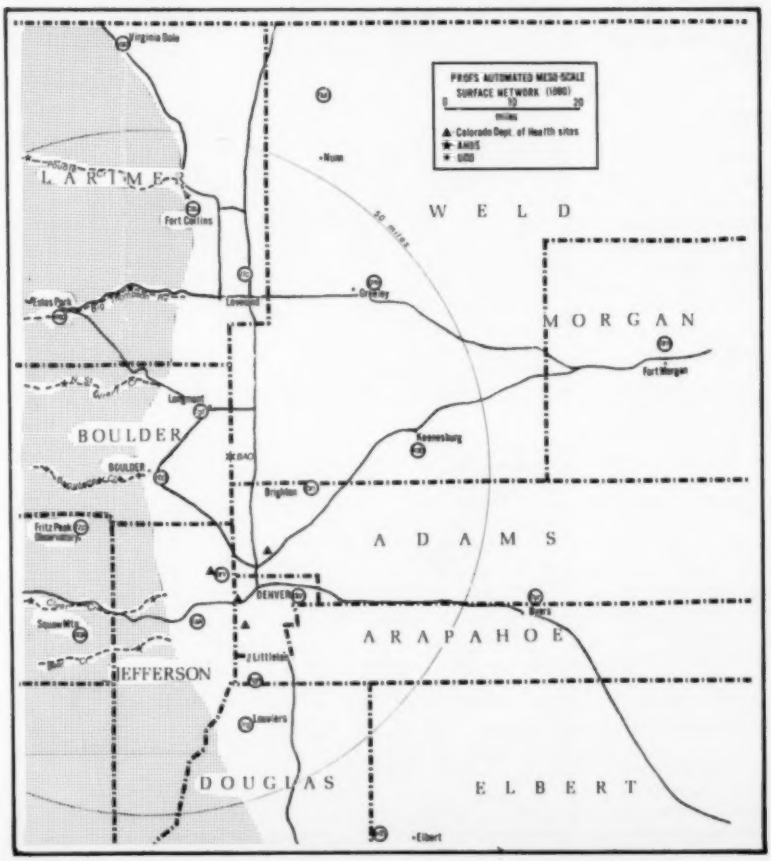
In this type of testing, says Beran, "you can freeze the atmosphere, run through an event a hundred times, to see how a technology alters the forecast." The facility in Boulder can be likened to an aircraft simulator. "But a simulator," says Beran, "is still a simulator. It's not the same as flying a 747."

So the next experiment, scheduled for this spring, will be to run through much the same type of tests in a true operational setting, the Denver Weather Service Forecast Office.

Because its purpose is to draw upon the best ideas and equipment available anywhere, the staff of PROFS includes people from each of NOAA's main divisions, and from other agencies and institutions, such as the Federal Aviation Administration. Special briefings and workshops are held to encourage outside input and participation. "We want the people who will be using this service to help design it," says Beran.

The first phase of PROFS is devoted to developing functional specifications for the Weather Service to use in procuring equipment. The next step will be to implement the system designed in the first phase, putting it into service at selected NWS offices.

PROFS is itself a technique, a way of getting new technologies into weather service offices. It is a continuing process. As new instruments and techniques are developed, says MacDonald, "We'll be going through this process again and again." ■



Instruments at these stations measure wind speed and direction, temperature, dew point, precipitation, and solar radiation. Ten of them also measure horizontal visibility.

NOAA's Western Regional Center—A Good Neighbor

Hal Alabaster

"Our plans will be closely coordinated with the Congressional Delegation, and with Federal, State, and local governments. As an environmental agency, NOAA will spare no effort to continue to be a good neighbor in Seattle." (NOAA statement, 1974)

During a recent conversation with NOAA officials, retired Army Colonel Jack Sweek, a member of the local community and long time participant in the development of plans for NOAA's Western Regional Center, observed that in those earlier days a great number of citizens were suspicious of NOAA's intentions. He noted his particular concerns about the effect the agency's plans would have on the surrounding community. Then he added, "When the statement was made that NOAA intended to be a good neighbor, I, along with others, decided to give the agency the benefit of the doubt."

The disposition of the land given to NOAA had been the subject of considerable controversy and public discussion in Seattle. In addition to NOAA, one segment of the community wanted to retain the air strip for use by general aviation; another viewed the land as an ideal location for a new city park. Located on the edge of a large body of fresh water, Lake Washington, adjacent to a residential area but a short distance from downtown Seattle, the site offered amenities attractive to everyone. A long unobstructed, over-the-water approach for aircraft and an almost idylic setting for a recreational park, its proximity to the University of Washington and the potential for fresh water moorage for NOAA's Pacific research fleet were paricularly important.

A Compromise

The decision by the General Services Administration to give part of the land to NOAA and the remainder to the city for a park seemed to bring the controversy to an end.

NOAA planned to construct a multi-discipline research center. It would consolidate over 1,200 employees, then working in various locations throughout the metropolitan area, mostly in space leased by the Government at considerable expense. This was to be the largest facility of its kind in the country bringing together the largest number of employees and program activities outside of Washington, D.C. An ambitious project; one that the agency anticipated would take 5 to 6 years to complete.

NOAA pledged full citizen participation in the development process. Interested groups were asked to nominate members to serve on a review panel. The membership

on the panel was to include environmental as well as community groups.

On April 14, 1975, the city council, under the strong urging of Councilwoman Jeanette Williams, passed a resolution establishing the Sand Point Liaison Committee. Mayor Wes Uhlman appointed 19 members to the group. Individuals on the committee represented 11 community clubs, a nearby country club, the city of Seattle, the University of Washington, and a group of citizens formed earlier calling themselves the "Friends of Sand Point Park." Staff support for the committee was provided by NOAA and the Seattle City Park Department. The first meeting was held on May 15, 1975, and has continued on a monthly basis over the subsequent years.

More Controversy

While NOAA and others involved in the creation of the Western Regional Center hoped that the earlier controversy, Aviation vs. Park and NOAA, would come to an end, such was not to be the case. Supporters of general aviation at Sand Point continued their efforts to have a portion of the land made available for their use through the State Aeronautics Commission. In December 1975 the chairman of the Liaison Committee, Frank V. Greif, wrote a letter to Governor Dan Evans, asking that he use his influence to halt State agency efforts to establish an airport at Sand Point noting, "The people of the city have voted against general aviation at Sand Point, the city council has approved no fewer than five resolutions calling for a park development without an airport." Shortly thereafter the governor lent his full support to the park and NOAA project, effectively ending State opposition. A number of individuals supportive of aviation continued their efforts over the years, but these all proved to no avail.

Friends indeed: Mrs. Jeanette Williams, President of the Seattle City Council and member of the Sand Point Community Liaison Committee (left top) at a 1979 ground-breaking ceremony at Sand Point; other members of the committee (left bottom), Mrs. Inge Strauss, Mrs. Dorothy McCormick, and Mr. Frank Greif, discuss plans with Mr. Dale Gough, Director of NOAA's Northwest Administrative Service Office; and (below) Colonel Jack G. Sweek, representative of the View Ridge Community Club and the Sand Point Committee.

Working with NOAA and the park department the citizens group, then under the leadership of Mrs. Dorothy McCormick, affected considerable influence on the development of the project. The overall design of the area under development made provision for the boundary between NOAA facility and city property to be effectively hidden. This would make the entire area appear as a single entity with trees and other appropriate landscaping. The group also influenced the exterior design of the buildings. Other areas where the committee expressed concerns and assisted NOAA in the development of its plans included landscaping, fencing, security, and transportation needs. In January of 1976 the Final Environmental Impact Statement on the project was issued.

More Opposition

In January 1977, a hearing was held in Seattle by the U.S. Army Corps of Engineers on NOAA's application to dredge in Lake Washington. The dredging would enable construction of piers for NOAA's research vessels. There was no opposition from Federal and State agencies including the State Department of Ecology, the Oceanographic Commission, and the Department of Natural Resources. However, there was opposition from a community group named Save Lake Washington. This group expressed concerns about the visual aspects of the concrete piers, NOAA vessels polluting the lake, navigational problems of NOAA vessels transiting through the Montlake Cut and the effect on traffic of the additional bridge openings needed to admit the vessels into the lake.

The involvement of Save Lake Washington eventually resulted in a long and sometimes difficult confrontation. The issue ultimately went to court, with an initial finding for Save Lake Washington. The court decision determined there were deficiencies in the original Final Environmental Impact Statement. The management of NOAA, after continued consultation, decided to repair the defects found by the court through the development of a supplemental impact statement. That process took approximately 18 months. When completed, it was presented to the court and, even though subjected to a series of appeals, a final finding was issued favorable to NOAA's plans.

"Neighbors for NOAA"

Through the entire period, NOAA continued to work closely with the Liaison Committee. Also, in direct response to Save Lake Washington, a group named "Neighbors for NOAA" was formed by Mrs. Inge Strauss. Some members of this new group also served on the Liaison Committee, including Col. Sweek and Mrs. Strauss. However, this organization was not connected with the offical panel. It did include a number of members from the earlier group named "Friends of Sand Point Park."

Over the intervening years, a number of changes were made in the project. For instance, shortly before the favorable finding by the 9th Circuit Court of Appeals, NOAA management, for budgetary reasons, decided on its own to eliminate all but a staging pier from the plans for the Center. Then, in late 1978 during Congressional appropriation hearings, funding for a planned Education Center and Visitors Information Center was eliminated, restored after a spirited defense by the Liaison Committee, and finally eliminated for good in 1981.

Spirit of Cooperation

Colonel Sweek, on the occasion of the appointment of Dr. John V. Byrne as NOAA's Administrator, wrote a letter on behalf of the committee inviting the new Administrator to meet with the group during a pending trip to Seattle. In that letter Col. Sweek said, "The Liaison Committee represents the culmination of 10 years of involvement by neighboring communities in the development of Sand Point. A conspicuous thread running through this entire period of community involvement has been the frequent interchanges between NOAA representatives and the surrounding communities, the sensitivity of local NOAA representatives to the various concerns expressed, and their efforts to accommodate these concerns. In response, we have actively and openly supported the objectives of the NOAA program. We believe this spirit of cooperation to be unique among Federal bureaucracy relationships with citizen groups and anticipate its continuation under your direction." Dr. Byrne met with the group in October 1981. The meeting took place in the training room of the Operations Building, the first structure to be completed on the site. During that meeting he pledged NOAA's continued involvement with the community.

Now, as the steel is being erected on the remaining structures and as the group holds its monthly sessions in the new facilities, there is a common feeling of pride and sense of achievement in seeing the project move toward completion. The promise made by NOAA in 1970 has been kept. The trust given by citizens, in view of that promise, has been worthwhile. ■

Directions

Reorganization of NOAA Proposed by Dr. Byrne

"Management has a responsibility to create an organizational structure which will allow you to do your best work." With this message to the NOAA family, Administrator John V. Byrne has initiated plans for a reorganization of the Nation's civil air-sea agency.

A major effect of the changes, Dr. Byrne believes, will be to shorten the distance between Administrator and employee and to provide simpler, more direct ways to accomplish NOAA's missions. The new plan, he said, will "organize NOAA's varying functions more logically, widen communication and coordination...reflect more accurately budget priorities, and reduce administrative overhead. The oceanic effort will be strengthened without vitiating the atmospheric program, and no operational element will suffer as a result.

"The changes I propose will be undertaken as a continuing process rather than a single event," he said. "I anticipate no significant dislocation, and extensive consultation with those concerned will continue until changes are effected."

The structure of the Administrator's office, including the position of Naval Deputy, will remain unchanged.

At the line level, there will be five assistant administrators: for the National Ocean Service, National Weather Service, National Marine Fisheries Service, National Environmental Satellite, Data and Information Service, and Office of Oceanic and Atmospheric Research. The positions of assistant administrator for coastal zone management, management and budget, research and development, oceanic and atmospheric services, and satellite service will be eliminated.

The National Ocean Service, built on a nucleus of the National Ocean Survey, will focus on development of a comprehensive strategy to address the increasing uses and opportunities of the oceans. It will group most of NOAA's ocean-related activities, except those dealing with living marine resources. It will encompass mapping and charting, geodesy, marine pollution, ocean mining and energy and coastal management responsibilities. Supporting areas will include those related to marine operations, ocean engineering and technology development.

The National Weather Service, whose head will be an assistant administrator rather than director, will report directly to the Administrator. Supporting services will include NOAA's data buoy activities.

The basic functions of the National Marine Fisheries Service will remain unchanged.

The activities of the National Earth Satellite Service and the Environmental Data and Information Service will be joined in a single organization, and the new component eventually will include climate programs.

The new Office of Oceanic and Atmospheric Research will conduct long-term and fundamental research through the Environmental Research Laboratories and external research programs, including university relationships. The office also will ensure closer coordination in the applied research and development work situated within the four service-oriented line organizations.

All staff offices will be headed by directors. Operation of five such offices—Congressional Affairs, Public Affairs, Civil Rights, General Counsel and the NOAA Corps—will not change. The remaining three staff offices will assume different responsibilities. They are:

Policy and Planning. This office will provide specialized staff support to the Office of the Administrator and to the main line components. Its functions will include continued responsibilities for policy analysis, long-term planning, international and interagency liaison, and ecology and conservation coordination.

Budget and Finance. This office will provide staff support for NOAA's budget formulation and execution activities and be the focus for management of NOAA's financial resources. It will encompass functions now assigned to the Office of Budget Resources and Management as well as the Office of Finance.

Administrative and Technical Services. This office will provide staff support in the areas of personnel, facilities, computing, management systems, and administrative operations and will provide day-to-day support to the main line components in these areas. ■

Winchester Is New Associate Administrator

James W. Winchester was sworn in as Associate Administrator of NOAA April 2. Administrator John Byrne congratulates Winchester as his wife, Ada, looks on.

Directions

Administration Asks $792.6 Million FY-1983 Budget

NOAA's budget for Fiscal Year 1983, which begins on October 1, 1982, is currently undergoing review by the Congress. On March 5 and 17, 1982, NOAA Administrator Dr. John V. Byrne presented the Administration's budget proposals to the House and Senate appropriations committees. Action on NOAA's request is anticipated this summer with hoped-for enactment of a budget by the end of September.

The Administration's FY 1983 budget request for NOAA seeks $792.6 million to fund essential ongoing program activities and a limited number of program increases in high priority areas. The budget provides:

- $141 million to support a broad range of ocean and coastal program services and related research. Included in the funding is a small, but important, requested increase of $300,000 to provide additional support for NOAA's activities related to the development of hard mineral resources and renewable energy (OTEC) from the oceans and to establish a regulatory and licensing framework for operations in those areas.
- $107 million to carry out NOAA's responsibilities in managing the Nation's fisheries resources and to provide for continued protection of marine mammals and endangered species.
- $244 million to provide for continued weather forecast and warning services nationwide. Included in this funding is a requested increase of $1.6 million to proceed with the evaluation, procurement, and installation of a Satellite Weather Information System (SWIS) which will improve the use of satellite imagery information to aid forecasters.
- $152 million, which includes additional funding of $35.5 million, to continue geostationary satellite (GOES) coverage of North America and operation of the polar satellite program.
- $152 million for the conduct of research and development in support of NOAA's programs. Included in this amount is an $800,000 increase to assess the commercial potential of metallic sulfides on the ocean floor, which holds great promise for alleviating some of the Nation's strategic metal shortages, and an increase of $300,000 to augment NOAA's study of the acid rain phenomenon.

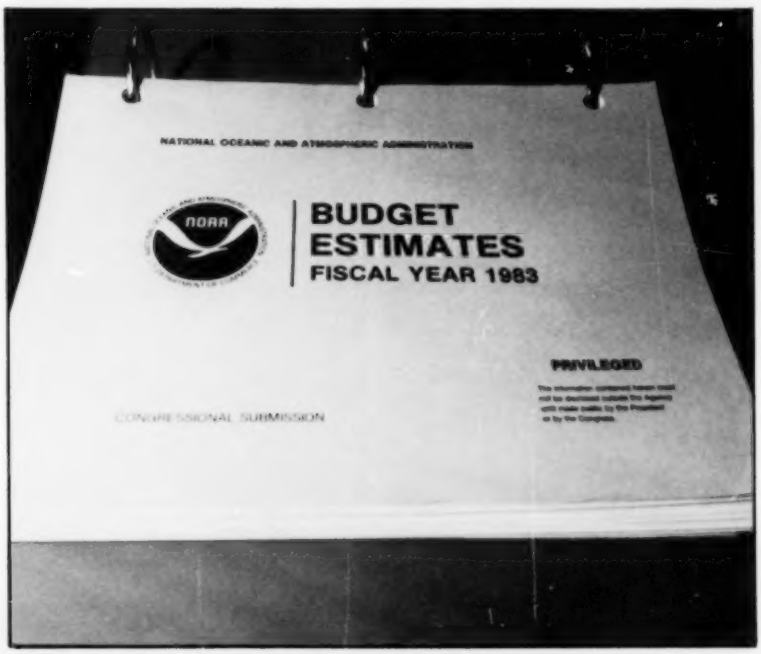
One of the major features of the NOAA FY 1983 budget is that it contains a series of new user fee proposals. In the 1983 budget there are four different, but philosophically similar proposals to attribute more directly the cost of certain Government services to the beneficiaries of those services. The programs involved are the aeronautical charting program, the nautical charting program, the aviation weather services progrm, and the LANDSAT data and information program. These programs involve some $67.7 million in expenditures. Enactment of legislation will be necesary to effect these changes.

The FY 1983 NOAA budget request is consistent with the Administration's efforts to reduce the overall level of Federal expenditures, eliminate unnecessary or low-priority program activities, and transfer the conduct or support for certain Federal program activities to States, local governments, or the private sector where appropriate. Overall, the FY 1983 budget represents an 8.3 percent decrease from the $864.3 million estimated to be available this year.

The program decreases proposed in the FY 1983 budget would produce savings of $169.4 million. These decreases involve a number of NOAA programs and activities, and include: the proposed termination of the Sea Grant program; elimination of one polar-orbiting meteorological satellite; reductions in Fisheries grant and research and development programs, terminating of regional ocean dumping projects and weather modification efforts, and elimination of agricultural weather services.

In an effort to accommodate the proposed changes in the FY 1983 budget in the most productive way, Administrator Byrne has initiated a new planning and budget process in NOAA to produce a coherent strategy for the future.

In an era of scarce resources the challenge is how to do more with less. NOAA program managers are meeting that challenge and working to carry out their responsibilities within available resource levels, while at the same time, looking for new and innovative ways to continue to meet their goals and objectives.



A Ship With Two Bosuns

Capt. C. William Hayes, NOAA

Ships are not merely transportation. They seem to have personalities developed and nurtured over the years, molded by their designers and their builders, modified by the tasks they are assigned, and refined by those they serve and those who serve on them. Many ships are similar, but no two are alike.

The ships in NOAA's fleet are no exception. The fleet consists of 22 research and survey ships ranging in size from the 303-foot Discoverer to the 86-foot Murre II. Painted white with buff and black trim, they support NOAA's worldwide ocean missions, such as fisheries research, nautical charting, or environmental assessment. The majority call either Seattle or Norfolk home. Like all ships, the NOAA ships are often similar but always different. This is the story of the Davidson, a ship with two bosuns.

Vital Statistics

The Davidson's size and shape are average for the NOAA fleet and certainly are not impressive when compared to the behemoths of the commercial fleet or the sleekness of the Navy's line ships. Her 175-foot length and 38-foot beam give the ship a length-to-beam ratio half again that of a supertanker or destroyer. She was certainly not built for speed, for no reasonable increase in the size of her twin 800-shaft-horsepower engines or the twin variable-pitch propellers they drive could push her 995 tons through the water much above her present 12 knots. Her complement numbers 40, including eight commissioned officers. She carries two survey launches, five small boats, computerized data acquisition systems, and a plethora of antennas. She is a stiff, cantankerous, middle-aged matron with a great deal of pride, endurance, and fortitude.

Built in 1967 by Norfolk Shipbuilding and Drydock Corporation of Norfolk, Va., the Davidson was one of 20 ships in the present fleet constructed during the sixties building era. Commissioned March 10, 1967, the ship left Norfolk in late summer for her permanent home port in Seattle, with stops at Acapulco, San Diego, and San Francisco.

Things have been decidedly different since that first year. Those intervening years have seen the Davidson charting the waters of the Pacific from the Mexican border near San Diego to Alaska's glaciered fjords near Valdez. Designed and built as a coastal hydrographic survey ship, her capabilities have been increased and enhanced as she has matured. She has been meticulously and lovingly maintained, and much of the credit for this goes to her two bosuns.

A Veteran Bosun

Increased effort is certainly one means of getting the Davidson's job done but how do two bosuns help? The traditional bosun, or boatswain, is the ship's officer in charge of the deck department, responsible for the general maintenance and cleanliness of the ship (excluding machinery and electronics) and the operation of all deck machinery, launches, and small boats. The Davidson's traditional bosun is CBM Charles "Chuck" Thompson, whose knowledge and training stem from 23 years in the U.S. Navy.

Enlisting in December 1955 at Houston, Tex., Thompson served on five different Navy ships and as master of a Navy tug. The assignments of these vessels varied from underway replenishment to repairs and included a shot at icebreaking, all excellent preparation for his tour aboard the Davidson. He began on February 1, 1979, the same day, as it so happened, he retired from the Navy as senior Chief Boatswain's Mate.

The second bosun aboard the Davidson, a newly developed swath sonar unit, was provided in 1978. This "Bosun" is the trade name General Instrument Corporation

Designed and built as a coastal hydrographic survey ship, the Davidson's capabilities, efficiency, and production increased with the installation of a second Bosun.

selected for one of its swath sonar systems, which is an integral part of the new National Ocean Survey Bathymetric Swath Survey System (BS^3) used for coastal mapping. While the present system is new and at present unique, the concepts and technology which went into the system have been developing since the end of World War II.

Developing A Second Bosun

It took 2 decades of development and refinement of side scan or swath-type sonar systems before any were considered sufficiently accurate to be used for mapping. In the early 1970's a system was produced which could acquire data of sufficient quality and quantity to generate real-time bathymetric coverage of bottom contours. The major drawback in the system was the necessity to perform all processing and plotting at a shoreside computer facility, obviating any review of the data by the ship before leaving the survey area. The existing system did not present, however, the nucleus for the type of system NOS had in mind.

In 1977, a contract was awarded to General Instrument Corporation, and a joint development effort ensued, with GIC providing the hardware and basic operating software. NOS provided survey software and utility programs, tide telemetry system, and arranged for Hippy, a heave, roll, pitch sensing system which acts like the Bosun's inner ear, providing precise orientation of sonar data.

Bosun's first operational test was in 1979 when the Davidson was assigned a 10-day project to map the San Andreas Fault between Cape Mendocino and Point Arena in northern California. The testing off northern California proved the feasibility and potential of the system. Modifications and improvements to the system were identified in subsequent tests during 1979 and 1980 and implemented last year. The full capabilities of the system will be utilized beginning this spring on the San Andreas Fault off Cape Mendocino, Calif.

Mapping the Sea Floor

Bosun will provide the equivalent of 21 continuous bottom profiles along the ship's track. Covering an arc of 105 degrees, it produces a swath over a nautical mile in width at the maximum depth range of 400 fathoms. Utilizing these depth ranges, real-time tides, precise navigation, vessel motion and attitude, and sound velocity in water, the system automatically produces real-time bathymetric contours, swath coverage, and vessel track plots at any selected scale or contour interval and in feet, fathoms, or meters.

The Davidson's Bosun is the beginning of a family of systems which have introduced a new era of greatly increased detail coupled with increased efficiency and production. The ship's future is bright. She intends to improve on her record of nautical charting and bathymetric mapping as she continues her odyssey, sailing into the future with her two Bosuns—and the Hippy. ■

The Two Bosuns: Chief Boatswain Chuck Thompson inspects a newly-installed sonar dome on the Davidson's hull, and the swath sonar unit, Bosun, in the ship's plotting room.

Probing the Dangers of Wingtip Whirlwinds

Rosalie Redmond

NOAA scientists using radar techniques have been measuring wakes generated by large jet aircraft in an attempt to determine how close together planes can safely take off and land.

Wing-tip vortices—small whirlwinds spinning backward from the wings of large aircraft—leave wakes potent and violent enough to destroy small planes following too closely, usually on takeoff or landing.

Dr. Russell B. Chadwick, who heads the study, believes airport radar ultimately may measure the vortices so accurately that it will enable control tower personnel to space aircraft more efficiently, protecting pilots and passengers, cutting holding-pattern time, and saving fuel.

Larger Planes Generate Wakes

Chadwick's group of Environmental Research Laboratory Scientists has found that every aircraft the size of a Boeing 727 or larger generates a wake vortex that can be detected by sensitive radars. Wake vortices are a side effect of the same physical forces

Large aircraft, such as this Boeing 727, create dangerous vortices—powerful little whirlwinds which could cause control problems in a smaller aircraft following the jet in for a landing.

that generate lift. Their existence has been known since the beginning of powered flight; however, it is only recently that operational problems associated with the phenomenon, with planes encountering wakes from other planes, have been experienced.

According to a 1977 report prepared for the U.S. Department of Transportation, the probability of a vortex encounter is greatest in the airport terminal area, where light and heavy aircraft operate on the same flight paths in close proximity. Vortex encounters can be especially dangerous there because of the low aircraft altitude.

Smaller Planes Vulnerable

The report also stated that the vortex problem has so far been largely confined to small general aviation aircraft. There have been only two commercial accidents, one a DC-9 landing accident at Fort Worth, Tex., attributed to vortex wakes. As for the vortex-generating aircraft, an unexpected finding of the DOT study was that vortex-related accidents have been caused by commercial (and military) aircraft of all sizes, many weighing less than 38 tons. The most frequent type of vortex-related accident was during the landing of one aircraft behind another.

The NOAA scientists are studying wake vortices with a highly sensitive Doppler radar they developed. With funding from the U.S. Air Force, they have also used the radar to study another, better known aircraft hazard, wind shear. "Although the Air Force has been interested in wind shear for several years, we found, in a study done at Stapleton Airport in 1979, that we could also see the vortices," Chadwick explained.

Several methods for detecting these vortex systems, involving optics, acoustics, anemometers and pressure sensing devices, have been under investigation for the past decade, but none have proven to be operationally promising.

It is known that radar can detect aircraft wakes, but little is known about the details of the interactions between aircraft wakes and electromagnetic (radar) waves. Before radar can be considered a viable candidate for hazardous wake detection, a greater understanding of the scattering of electromagnetic waves by aircraft wakes is needed.

To learn more about wake detection, the Office of Systems Engineering Management of the FAA sponsored and funded the NOAA study. The NOAA scientists were contracted to determine exactly which part of the aircraft wake radar can detect.

The Stapleton Study

The month-long study, which began in mid-November 1981, was conducted from an instrumented van located north of Stapleton's north/south runway. A Doppler FM-CW (frequency-modulated continuous-wave) radar was used. The radar, the work of scientists in NOAA's Wave Propagation Laboratory, uses two antennas which resemble huge bongo drums. One antenna transmits a continuous microwave signal that sweeps up and down a range of frequencies while the other simultaneously receives return signals. The FM-CW measures the differences in frequency, between outgoing and returning signals, from which the range and velocity of a distant moving object can be inferred.

As a plane takes off, the radar scans through its path. The information is sent to a computer in the van, which produces a graph that indicates the radial velocity (the velocity toward or away from the radar) of the air at different ranges in the radar beam. The vortex is readily apparent in this type of display. The operator then indicates on the graph the type of plane, which runway was used, whether it was taking off or landing, and whether or not the plane was above or below the radar beam.

Problems with Oversensitive Radar

For a while, the scientists had some difficulty determining what was appearing on their graphs. The readouts weren't consistent. "The radar is so sensitive," Chadwick says, "We could pick up a tiny insect over one-half mile away, and that would show up on our printouts. Hawks, circling off to the side of the radar beam, also caused problems. However, once we identified these biological returns, we could sort out the vortex returns."

When a vortex is detected on the graph, the scientists start scanning in different modes. "We now can see where the vortices are," says Chadwick, "and we know some of their behavior. For example, they drop toward the ground after they spin off the wind tip." If the air is still, the vortex may linger for as long as 4 minutes. If a wind is blowing, the vortex is blown away from the runway immediately. The vortex is only hazardous for about 1 minute after it's generated.

"By being able to detect the wing-tip vortices and determining their dissipation, a control tower could space aircraft accordingly," says Chadwick. He continues that "the FAA has identified 16 major airports where they would like to install this type of capability. If this is done, the controllers would not have to be trained in its operation. The radar would simply send the vortex information to a computer in the control tower, and the computer would display a red or green light, telling the controller whether or not the separation between planes should be decreased." ■

This scientist with the Environmental Research Laboratories controls the bongo-drum-like antennae of a Doppler radar, scanning through the wake from aircraft as they pass overhead during the NOAA study.

For Fisheries: "A more aggressive leadership role..." *(Continued from p. 6)*

Q. ***Take for example, Japan, where fish makes up a substantially larger portion of the diet than it does in the United States. Is the fish that is displayed in markets in Japan fresher, better handled, tastier in than in the United States?***

A. The Japanese fishermen, the shore side worker, processer, wholesaler, and retailer all are very quality conscious. The product is into the marketplace quicker, more attractively displayed, whether it is in a fresh, frozen, or in semi-preserved state, and is presented to the consumer in an eye-appealing way. The general rule is if its high quality is there, it's sold; if the quality is not there, the product is not even displayed and may be sold for other than human food purposes.

Q. ***To bring U.S. packaging, handling, transportation, and marketing up to the level that is equal to Japan's, are we talking about a substantial change in the way we operate?***

A. It is substantial and it is fundamentally a big undertaking. But it need not cost a tremendous amount of money. It is more a matter of attitude—attitude on the part of fishermen so that their fish are iced more quickly after they're taken from the water, that the holds are cleaned and sterilized after the fish are taken out, that the product is transported from the dock in a cleaner and more refrigerated environment, that it is processed and packaged more rapidly. As it's transported to the marketplace there must be a continued awareness that they're dealing with a highly perishable commodity that must be shipped faster and kept under better refrigerated conditions. Some of the wholesalers and retailers are doing this now and their sales reflect it. It must be done, I think, on a nationwide basis, because one bad fish and the consumer generally is turned off. On the other side, the consumer should understand that fish is low in saturated fats, healthier from a dietary standpoint, and is a total protein. Most fish are marketed now in a bone-free form, so what you buy is totally edible, with very little waste. Whereas the purchase of chicken and red meats include bone, fat, skin, and other parts that often are disposed of. So we should be selling fish on a per-pound of protein rather than on per-pound of product basis. If people could make that translation then they would recognize that fishery products, per-pound of protein rather than per-pound of product, are a most economical buy.

Q. ***Is the Fisheries Service involved in accomplishing what you've discussed?***

A. To the degree that we are working with the Fishery Development Foundations and with the various consumer groups and certain elements of the industry, yes. We do not have a large program ourselves. We feel this is more legitimately a role of the industry and we are performing more of a catalytic role of getting the industry to make this transition, through the foundations and other means, rather than spending large amounts of money ourselves.

Q. ***Is the American fishing industry in better shape because of the Magnuson Fishery Conservation and Management Act? (MFCMA established the 200-mile fishery conservation zone which gives U.S. fishermen first chance at the fishery resources in the zone.)***

A. In general, the resources and the industry are in better shape today than they were prior to the Act. One has to look at it on almost a case-by-case basis. In some instances, the stocks have recovered nicely and are being wisely managed and used by an industry that has prospered relative to the rest of the economy. In other instances, the resources have not recovered to what might be considered sustainable yield and the industry has continued to stay in the economic doldrums. But in general, I think the gross revenues generated by the commercial fishing industry have grown substantially since the passage of the Act.

Q. ***What is the future of foreign fishing off our shores?***

A. In the short run, foreign fishermen will continue to harvest fish in our zone. I think there will be a transitional period over the next decade in which there will be a gradual reduction of foreign fishermen harvesting fish in our zne. The next step might be for foreign processors to play a major role in the zone. They will be supplied by American vessels that are catching various species. Eventually there will be a gradual evolution of joint investments by processors from both abroad and in the United States, in order to assure that the growing foreign markets get the amount of protein they want. And then, I see American processors taking over the market and supplying it directly from U.S. sources. So in the next 10 to 15 years you'll see an evolution take place, where foreign fishing and processing will gradually diminish and be replaced by American efforts.

Q. ***The tuna industry and, to some extent, the shrimp industry are vertically integrated; that is, they control not only the catching of the fish but the processing and sometimes the distribution. Do you see an expansion of vertical integration in other fisheries and the resulting reduction in the traditional "mom and pop" fishing operation?***

A. I think it will occur. We seem to have come full circle. After the Second World War several firms divested themselves of their fleets and went to foreign sources for the raw material. I think some of these firms will eventually come back and develop more of a vertically integrated business—equipping themselves, either directly or indirectly, with a harvesting fleet in order to return to a year-round source of raw materials.

Q. ***Is it likely this will happen with one fishery before another.? How about the New England groundfish fishery?***

A. In my view, the New England groundfish fishery will continue to be a highly diverse, individualistic fleet. Since it's supplying a fresh fish market, it will probably never move aggressively toward vertical integration. Vertical integration, if it occurs at all, will probably be in the Bering Sea and the Gulf of Alaska with their large potential of Alaskan pollock, Alaskan cod, and several other finfishes that lend themselves to freezing and marketing.

Q. ***Fishermen seem to feel that the Fisheries Service is a natural adversary. For example, the New England fishermen have been claiming for some time that stocks are improving, while NMFS scientists and biologists are saying just the opposite—the stocks are declining. What's the reason for this apparent contradiction?***

A. There are a variety of reasons. In New England few fishermen remember the rapid decline in some of the stocks that occurred in the early 1960's. For example, when a single, large year-class of haddock appeared in the fishery in 1977, the fishermen quite naturally said, "We have seen more fish than we've ever seen before." And they were absolutely correct. But what they failed to understand was that it was a single age-group of fish. The stability of the fishery of the past, the period from the 1930's until the early 1960's, was based on three-, four-, and five-year classes supporting the fishery. What we are trying to communicate to the fishermen is that there cannot be stability and long-term vitality operating on a single year-class.

(Continued on p. 22)

For Weather: "Protecting life and properity..." *(Continued from p. 7)*

Q. ***What role do weather satellites play in forecasting?***

A. Satellites are key observational tools for the entire weather service. In order to predict the weather for even 1 or 2 days in advance, let alone 6 or 7 days, you must have global weather information. Temperature sounders on polar-orbiting satellites provide absolutely essential ingredients for the numerical models at NMC. As the soundings get better, so will the guidance forecasts from NMC to our field offices. The geostationary satellites provide detailed and vital information for local stations. Blending those images with radar provides the best vehicle for looking at storm-scale events. Right now this is a laborious, time-consuming manual process. In the next few years we hope to do it electronically and automatically.

Q. ***You mentioned that weather is really a global phenomenon and you needed global atmospheric information to predict weather adequately. What is being done on the international front?***

A. Most of what is accomplished is done through the World Meteorological Organization, a specialized agency of the United Nations. There are 152 member nations. We try to bring about total coordination of all observations from the entire world. We also collaborate in a communications system to bring all those observations into World Weather Centers. Our National Meteorological Center is one of those centers. The cooperation in meteorology has been the best example of getting nations to work together in effective and meaningful ways. It's everybody's atmosphere.

Q. ***Will the new technology in place and in the mill improve our ability to forecast, let's say 10 days ahead?***

A. Yes. We have a research effort in place and are instituting an operational capability that will permit us to go just as far as our scientific knowledge permits. With the new computers at NMC we will be able to run the most sophisticated model that can be put together today and move that time-frame out step-by-step.

Q. ***What is the major impediment to accurate long-range forecasts?***

A. It's the atmosphere itself and the way it works. In the Global Atmospheric Research Program we're trying to determine the theoretical limit of how far in advance you can forecast day-by-day. We know it's less than a month. Some argue it's no more than 2 weeks in advance. A few insist it's on the order of 10 days. There is definitely an inherent limitation, just by the atmospheric make-up, on how far in advance you can forecast. With our advances, I'm hopeful that in the 80's we'll see day-by-day forecasts out to at least a week and maybe 10 days.

On the other hand, one of the big objectives of the National Climate Program and the World Climate Program is to see if it's possible to put out a general forecast of "below normal, normal, above normal" for a year in advance. But that's in the research state. While we're gaining insight, we don't know how far we'll get.

Q. ***What's the hardest place in the United States to forecast?***

A. The answer has to be "everywhere." Whenever I ask my Boston forecaster that question, he'll say Boston. In Cleveland, the forecaster claims it's Cleveland. In Oklahoma City, it's Oke City. When they're transferred, their views somehow change.

Q. ***In addition to the daily forecasts and severe weather warnings for the public, isn't weather important to other sections of the economy?***

A. Yes. Through the decades we have been responsive to agriculture, aviation, forestry, and many other sectors such as NASA's space flight missions. In fact, we will see an enormous increase in the importance of weather services to food and fiber production; to water management; and for energy planning, distribution, and conservation in the years ahead. While we will always give top priority to our warning mission, I believe these activities, because of the enormous economic implications, will become just as important. Agriculturalists are trying to increase their production and they realize that to do so they must be very weatherwise. We must respond to this need for the good of this Nation. The NWS will never manage our water resources, but it will be involved in providing the right weather and river information for intelligent water resource management.

Q. ***We've talked about the uses of weather information in many areas. There's a substantial constituency out there in the marine and fisheries business, is there not?***

A. Yes. I view the weather and oceanographic services we provide in the coastal and offshore waters as simply being an extension of our public services. There are many, many users in need of weather and oceanographic information in those zones. We've been asking our forecasters to do the impossible in providing forecasts for our coastal and offshore waters. We give them very little data on which to base the forecast, and, in fact, we have not devoted enough forecasters to serving that area. We're establishing ocean service units at key locations along our coastal areas, including Alaska and Hawaii. This is an extremely important service—not just for the boaters along the coast, but for transportation, for fisheries, and all others operating at sea. Furthermore, you need those observations to forecast for the coastal waters.

Q. ***What is the relationship between the NWS and private meteorologists?***

A. We have a good relationship and I feel that there will always be a role for both the Government meteorologist and the private sector. My basic philosophy is to provide weather services to protect our people and enhance this Nation economically. This requires the full cooperation of the NWS with private meteorologists. The NWS cannot provide a very specific forecast for a very specific industry. That's the role of the private meteorologist. There will always be an interactive boundary between the two groups. This actually is healthy. The private meteorological firm must have the data and guidance products from our NMC to operate. But there is no way for private meteorologists to get into the warning process. It would cause chaos in times of emergency. I see both areas growing in years to come.

Q. ***In the light of budget limitations, I suppose like the rest of NOAA, you're looking toward user charges as one possible tool to help you accomplish more?***

A. We've given a lot of thought to this question and have examined all possibilities. In the FY 1983 budget we're proposing to recover program costs in the aviation area. We're working closely with the FAA on this matter. Cost recovery in aviation is already in place in other parts of the world.

Q. ***Is the American taxpayer getting as much, more or less, for his or her weather dollar as in the past?***

A. The Weather Service's budget is about $220 million a year. The number of Americans is about 220 million, so your weather services cost each person about $1 per year. Whenever I've asked people whether they think a dollar a year is a good investment, knowing full well that we are not 100 percent accurate with all our forecasts, the response has always been, "the best investment the Government has ever made." ■

May 17-23, 1982

National Flash Flood Awareness Week

Credit: Artesia (N. Mex.) Daily Press

About 2,000 Americans perished during the past decade in flash floods which struck with dramatic suddenness in rural and urban areas alike across the Unites States. Property damage is running at about a billion dollars a year.

By latest count, more than 20,000 communities and recreational area in this country have been identified by the American Red Cross as being vulnerable to flash floods. And the problem is growing.

In an effort to help heighten public awareness of the flash flood problem, May 17-23, 1982, has been designated as "National Flash Flood Awareness Week" by the National Oceanic and Atmospheric Administration. This effort is being conducted in cooperation with the Federal Emergency Management Agency and the American Red Cross.

During this week of observance, special events will be conducted in a number of high-risk areas across the country by field offices of NOAA's National Weather Service to reach the communities, the schools, and other audiences.

According to NOAA Administrator Dr. John V. Byrne, "the more people are fortified with facts about the flash flood problem, the bet- they will be equipped to help reduce the .oll in life and property from these traumatic events".

The flash flood problem in the United States is growing, partly because of the spread of urban development and partly from increased population mobility. In cities, removal of vegetation increases the peak flow rates of small streams. Bridges, culverts, and buildings often are constructed in a manner that impedes the flow of water. In the countryside, expanding use of mountainous areas and narrow canyons for recreation is exposing growing numbers of unwary visitors to flash floods.

The deadliest flash flood event on record occurred on June 9, 1972, when stationary thunderstorms dumped as much as 15 inches of rain on the eastern slopes of the Black Hills of South Dakota during the late afternoon and evening hours. Flash floods killed 237 people and caused $164 million in damage in Rapid City and surrounding recreational areas. ■

For Fisheries: "A new role..." *(Continued from p. 20)*

Q. ***As the fishing industry becomes more economically important, will it have more political clout?***

A. Well, one can look at the fishing industry and marvel at the degree of political clout it presently exerts for its size. It contributes about one percent to the gross national product, yet receives a very high degree of attention from members of Congress. As the industry grows, I think it will become more economically vital and be able to stand on its own two feet and compete internationally as well as domestically with the best of the world's economy.

Q. ***Recreational fishermen seem convinced that the Fisheries Service serves commercial fishermen almost soley, to the exclusion of the sports fishermen. Do you have any plans to rectify this notion?***

A. Yes. We have recently implemented a marine recreational fisheries policy that will open the door to virtually all of our programs for members of the recreational fishing industry. Most recreational activity takes place totally in State waters; and we can have little impact there other than to serve as a catalyst, working with the States, to open up more opportunities for recreational fishing. In other areas we can act as a catalyst with the recreational fishing constituency and the ancillary manufacturers to create opportunities to expand their businesses.

Q. ***The Service recently completed an aggressive campaign promoting fishery products, called Catch America. Could you tell us a little about its results and plans for the future?***

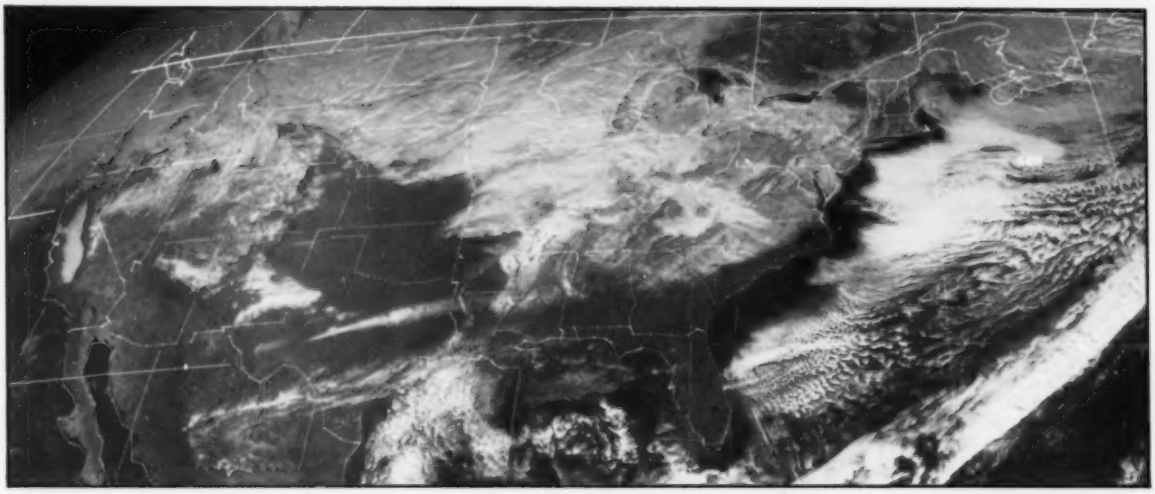
A. I think Catch America was a success. At least, I'm more than willing to give the program credit for many of the successes that occurred. I note that sales of fresh fish in the United States increased substantially in 1981. They did so, in part, at the expense of frozen products, which means that American consumers are becoming more cognizant of high quality and believe that fresh fish equates to quality. In addition, there is a greater mix of species available in the American marketplace, and they are selling. Products that were not selling a few years ago, such as squid and other products, are being more aggressively marketed. We must continue to build on this through the foundations and the industry to assure that there is continued shipment of fresh, high-quality fish into the marketplaces.

Q. ***One final question. How is running the Fisheries Service different from working for it? (Gordon has served as a regional director and recently as director of Resource Conservation and Management.)***

A. Running it has the responsibility, and in some respects the pleasure, of trying to change policy—to work closely with industry in evolving new policy, legislation, programs, and to do so we must achieve closer communications with a broader range of people. I think the industry is looking for a more enlightened and robust leadership than they've seen in the past. In short, I find it an exciting, interesting time. ■

VIEW FROM SPACE

The Big Snow



On February 15 the Nation reeled from a double blow of bitter cold and huge snowstorms. This GOES satellite image shows snow from Texas through Georgia and from the Carolinas up into New England. Most of the midwestern and north-central United States, snow-covered on the ground, is obscured by clouds in this photo, but snow can also be seen in Colorado, New Mexico, Utah, Arizona, Wyoming, Idaho, Nevada, and California. Florida alone escaped. ■

Credit: Wide World Photos

Radio 'Hams' Fill A Data Gap

John H. Brown (W7CKZ)

On May 18, 1980, Mount St. Helens in southwest Washington erupted, spewing steam and ash 12 miles into the atmosphere. Quiet for over 120 years, the mountain had been venting clouds of steam since late March, prompting the evacuation of forest rangers, loggers, and local residents. Following the main eruption, the death toll stood at 24 and forest fires, flash floods, and the choking cloud of ash threatened the lives and property of thousands living near the mountain. Almost 150 square miles of forest had been laid waste. Thousands of miles of roads were blocked. Rivers were clogged and extensive damage had been done to crop lands and wildlife. Estimates placed the damage at $1.5 billion and the region was declared a disaster area by the President.

After the devastation of the eruptions, a variety of instruments had to be installed in, on, and around the mountain. Damaged equipment had to be replaced, and in some cases new devices installed. One of the National Weather Service's concerns was tracking precipitation. With late summer and early fall rains expected soon, the urgency of the problem was heightened. Floods created by runoff from the nearby blasted landscape and the destroyed watershed that used to form a buffer for the many rivers and streams that flow down the mountain presented a life-threatening danger. The need for observations was crucial.

Pacific Northwest amateur radio operators were particularly aware of the problem and had a unique familiarity with the mountain. Nearly 300 amateurs had handled thousands of messages, relaying scientific observations and health and welfare reports, during the early periods of the mountain's activity following the May 18 eruption. So the operators, many of them veteran observers of Mt. St. Helens, banded together in an effort to assist the National Weather Service Forecast Office in Seattle with the needed rainfall reports.

Credit: Department of the Interior

Credit: Joe Winter, WA7RWK

(Above) Mount St. Helens, May 18, 1980. (Right) Dick Ryan, a radio amateur prepares to send weather observations in a computer-to-computer linkup from his home to the Weather Service.

First Contacts

Initial contact was established between the National Weather Service and state amateur radio operators when Chuck Ruscha, Emergency Preparedness Program Leader, was scouting for communications people to work as severe weather spotters in the Weather Service's Skywarn program. Ruscha contacted John Kelly, W5KKN, Director of Communications for Pierce County, Wash. Kelly, in turn, put Ruscha in touch with Joe Winter, WA7RWK, the Section Emergency Coordinator for the Amateur Radio Emergency Services (ARES) of Washington State. ARES is sponsored by the American Radio Relay League. The League assists many public service organizations, such as the American Red Cross and the Salvation Army.

With Joe Winter coordinating the people and resources of the amateur radio community, plans were made with the Weather Service to create an observation and communications system to increase the accuracy and effectiveness of weather forecasting in the Pacific Northwest.

Additional Benefits

As the reporting system started up, addi-

Credit: Dick Bolding, Washington Department of Game

The volcano's blast destroyed watershed and changed the course of streams, making the need for observations of critical importance to flood forecasters.

tional benefits accrued. Provisions were made for an amateur radio station to be set up at the Lake Union National Weather Service Forecast Office in Seattle. A radio antenna and connections were permanently installed, allowing amateur operators to communicate directly from the weather office with observers in the field. These radio links are crucial when telephone circuits are lost.

The initial group of amateur radio operators was furnished with rain gauges and trained by Weather Service personnel to observe weather parameters, record information, and accurately report its findings via amateur radio to the Seattle office.

After a few test runs, the observation and reporting system was ready to go. Operation of the amateur radio reporting network began at 10:00 Pacific local time, on 3.910 MHz, November 3, 1980. Some 20 operators make their initial weather observations and reported to a network control station, which passed the data by telephone to the Seattle office. Today, this operation continues around the clock, 7 days a week.

Amateur radio operators, being tinkerers by nature, are always trying new methods in science and communications, and these amateurs are no different. One of the weather network members, Dick Ryan, W7RGD, decided to program the weather information into his home computer as the reports were transmitted into the network control station. After the information is entered into his computer, he telephones the National Weather Service office in Seattle and lets his computer "talk" to the Government computer, entering data quickly and accurately.

Network Expands

The amateur radio weather network has now expanded to include approximately 68 members throughout Washington, who take daily observations and radio these reports to the network control station.

The Weather Service uses the "ham" reports to verify some of their forecasts and to obtain actual readings on the ground, unavailable from radar or meteorological satellite pictures. The weather in Washington can vary greatly from valley to valley or mountainside to coast, with significant weather occurring between the regular airport observation points that cover the entire State. Data from "hams" eventually go into the AFOS (Automation of Field Operations and Services) computer/communications system and is distributed by the NOAA Weather Wire to radio and television stations, other governmental agencies, and other National Weather Service offices in the State.

Now that the entire State is covered, the program can be used to report other types of weather, including thunderstorms and the rare tornado that may be sighted in the Pacific Northwest. Many of the "hams" have built their own weather instruments—anemometers, mounting towers, and readout equipment—to enhance their data collection.

Forecaster Ruscha says, "It's like turning on the lights on the front porch. We can get some ground truth from many more areas all over the State. We see what nature has left at our doorstep."

One of the most valuable features of this amateur radio network is that the Weather Service can use these special observations and reports to supplement its own regularly submitted 24-hour reports.

Vital Reports

Dr. Arthur Hull, Seattle Meteorologist-In-Charge, says that many of the "ham" precipitaton reports are vital since, on occasion, Weather Service instruments may freeze during the winter months, in the higher elevations near Mt. St. Helens.

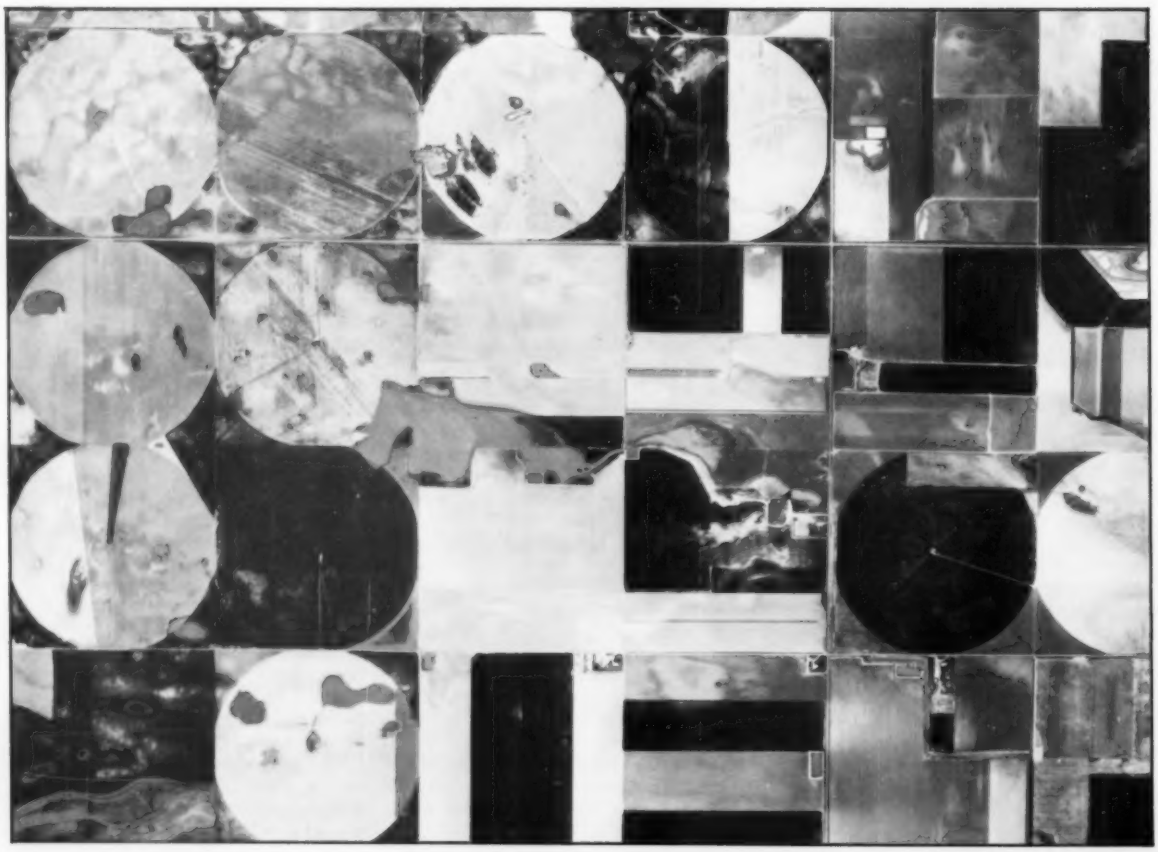
"The greatest benefit is to the taxpayer," says Dr. Hull. "These supplemental daily observations from the entire State are given to us at no added cost to NOAA or to the National Weather Service." •

Credit: Joe Winter, WA7HWK

CITY SCAPE

City Scape Goes Country

These geometric forms appear in an aerial photograph taken by a NOAA aircraft flying a survey mission near Garden City in western Kansas. A closer, ground-level, look shows long sections of water pipe on wheeled carriages sweeping around the tilled fields like a clock's second hand, irrigating the corn crop, and leaving the pattern seen from the air. The plots in the National Ocean Survey photo have different crops in varying stages of cultivation. ■



Slenderizing With Seafood

Diet the sensible seafood way. You can lose weight, feel better, and enjoy your diet with fish and shellfish on the menu. An average serving of seafood provides nearly all the animal protein that is needed each day to help the dieter build and repair body tissues. In addition, fish and shellfish are lower in calories than most other protein sources. And just because you're not on a diet, there's no reason you can't join the calorie-counters in these delicious and satisfying dishes.

SEA GARDEN ANTIPASTO

3 cans (3¾ or 4 ounces each) Maine sardines
2 cans (4 ounces each) button mushrooms
Marinade
6 large lettuce leaves
24 cucumber slices
18 celery sticks
12 radish roses
12 tomato wedges
6 green pepper rings

Drain sardines and mushrooms. Place in a shallow baking dish. Pour marinade over sardines and mushrooms and chill for 30 minutes. Prepare vegetables and chill. Remove sardines and mushrooms from marinade. Drain. Arrange all ingredients, except the marinade, attractively on lettuce leaves, dividing the ingredients evenly among the 6 servings. Serves 6. Approximately 130 calories in each serving.

MARINADE

½ cup low calorie French dressing
¼ cup soy sauce
2 tablespoons wine vinegar
2 tablespoons water
1 clove garlic, crushed
Dash powdered ginger
Dash pepper

Combine all ingredients and mix thoroughly. Makes approximately 1 cup marinade.
Lobster, tuna, crab, pickled herring, or shrimp may also be used in this recipe.

FISH CAPER

24 frozen fried fish sticks (¾ to 1¼ ounces each)
Caper Sauce

Place frozen fried fish sticks in a single layer on a greased cookie sheet, 15 x 12 inches. Bake in hot oven, 400° F., for 15 to 20 minutes or until heated through and crisp. Serve with Caper Sauce. Serves 6. Approximately 240 calories in each serving.

CAPER SAUCE

1 cup yogurt
2 tablespoons chopped capers
1 tablespoon lemon juice
1 tablespoon chopped parsley
2 teaspoons instant minced onion
1 teaspoon grated lemon rind

Combine all ingredients and mix thoroughly. Chill. Makes approximately 1¼ cups of sauce.

CHEF'S SALAD CHESAPEAKE

1 can (12 ounces) blue-crab meat or other crab meat, fresh, frozen, or pasteurized or
2 cans (6½ or 7½ ounces each) crab meat
1 package (10 ounces) frozen asparagus spears
6 lettuce cups
Lemon-Caper Dressing
3 hard-cooked eggs, sliced
Paprika

Thaw frozen crab meat. Drain crab meat. Remove any remaining shell or cartilage. Flake the crab meat. Cook asparagus spears according to directions on package. Drain and chill. Place 3 asparagus spears in each lettuce cup. Place about 1/3 cup crab meat on asparagus. Cover with approximately 2 tablespoons Lemon-Caper Dressing. Top with 3 slices hard-cooked egg. Sprinkle with paprika. Serves 6.
Approximately 130 calories in each serving.

LEMON-CAPER DRESSING

½ cup low calorie salad dressing (mayonnaise type)
1 tablespoon drained capers
1 tablespoon lemon juice
½ teaspoon prepared mustard
½ teaspoon Worcestershire sauce
2 drops liquid hot pepper sauce

Combine all ingredients. Chill. Makes approximately 2/3 cup salad dressing.

COD CURRY

2 pounds cod fillets or other fish fillets, fresh or frozen
1 cup thinly sliced celery
1 cup thinly sliced onion
1 tablespoon melted fat or oil
1 teaspoon curry powder
1 teaspoon salt
Dash pepper
¾ cup skim milk
Paprika

Thaw frozen fillets. Skin fillets and place in a single layer in a greased baking dish, 12 x 8 x 2 inches. Cook the celery and onion in fat for 5 minutes. Stir in seasonings and milk. Spread over fish. Bake in a moderate oven, 350° F., for 25 to 30 minutes or until fish flakes easily when tested with a fork. Sprinkle with paprika. Serves 6.
Approximately 140 calories in each serving.

FLOUNDER IN WINE SAUCE

2 pounds flounder fillets or other fish fillets, fresh or frozen
1½ teaspoons salt
Dash pepper
3 tomatoes, sliced
½ teaspoon salt
Dash pepper
2 tablespoons flour
2 tablespoons butter or margarine, melted
½ cup skim milk
1/3 cup dry white wine
½ teaspoon crushed basil
Chopped parsley

Thaw frozen fillets. Skin fillets. Sprinkle fillets on both sides with salt and pepper. Place fillets in a single layer in a greased baking dish, 12 x 8 x 2 inches. Arrange tomatoes over top of fillets. Sprinkle with salt and pepper. Blend flour into butter. Add milk gradually and cook until thick and smooth, stirring constantly. Remove from heat and stir in wine and basil. Pour sauce over top of tomatoes. Bake in a moderate oven, 350° F., for 25 to 30 minutes or until fish flakes easily when tested with a fork. Sprinkle with parsley. Serves 6.
Approximately 180 calories in each serving.

QUICK OYSTER PICKUP

1 can (12 ounces) oysters, fresh or frozen
2 cups oyster liquor and water
1 package (1¾ ounces) cream of leek soup mix
1 cup milk
1 tablespoon chopped parsley

Thaw frozen oysters. Drain oysters, reserving liquor. Add oyster liquor and water to soup mix and bring to a boil, stirring constantly. Reduce heat and simmer for 10 minutes. Add milk and heat, stirring occasionally. Add oysters and heat 3 to 5 minutes longer or until edges of oysters begin to curl. Sprinkle with parsley. Serves 6.
Approximately 65 calories in each serving.

United States
Government Printing Office
Division of Public Documents
NOAA Magazine
Washington, D.C. 20402

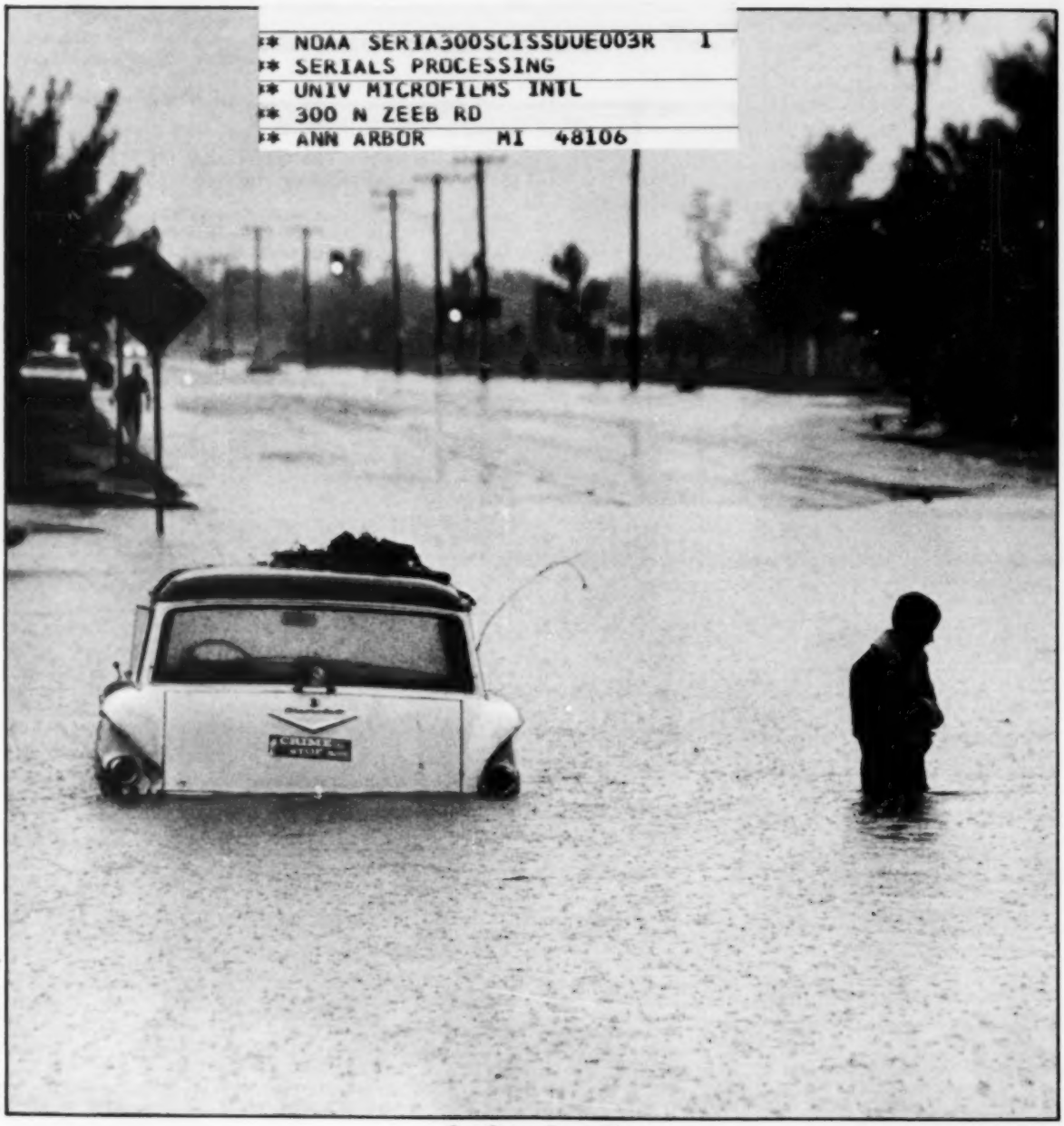
Official Business

AN EQUAL OPPORTUNITY EMPLOYER

Postage and Fees Paid
U.S. Department of Commerce
Com-210

Second Class Rate

** NOAA SERIA300SCISSDUE003R 1
** SERIALS PROCESSING
** UNIV MICROFILMS INTL
** 300 N ZEEB RD
** ANN ARBOR MI 48106



Credit: The Arizona Republic

See Story Page 22